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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/633,071	08/01/2003	Thomas J. McIntyre	BA-00590 (1763-13-3)	6330

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EXAMINER	
LEPISTO, RYAN A	

ART UNIT	PAPER NUMBER
2883	

DATE MAILED: 04/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/633,071	MCLNTYRE ET AL.	
	Examiner	Art Unit	
	Ryan Lepisto	2883	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 March 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *5-8 and 10-14* is/are allowed.

6)☒ Claim(s) *1-4,9 and 15-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. **Claims 1 and 9** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Thomas (US 5,198,008)**.

Thomas teaches a method of optically interconnecting layers in an integrated circuit (Figs. 1A-F and 3) comprising forming a first optical core layer (20) over a substrate (10) having a first substrate layer (12) and an additional support layer (16) (Figs. 1A-B, column 3 lines 11-65), forming a first cladding layer (24) on the first core layer (20) (Fig. 1D, column 4 lines 3-9), removing portions of the first cladding layer (24) to for a 90 degree angled via (26) exposing the first core layer (Fig. 1D, column 4 lines 9-11) and forming a second optical core layer (28) on the angled via (26) and first core layer (22) (Fig. 1E, column 4 lines 17-23).

Thomas does not teach expressly the angle of the angled sidewall being less than 90 degrees. According to applicant's specification, the critical angle of the sidewall is less than a critical angle to ensure total internal reflection (page 7 lines 18-19). No critical upper limit is defined in the specification, only an example of less than 50 degrees when the waveguide and cladding layers are a specific material (page 7 lines 24-26).

At the time the invention was made, it would obvious to a person of ordinary skill in the art to select any angle less than a angle to ensure total internal reflection like 90 degrees as taught by Thomas as described above. Applicant has not disclosed that an angle less than 90 degrees provides an advantage, is used for a particular purpose, or solves a stated problem and therefore lacks criticality.

The motivation would have been to reduce delays in circuit functions by using optical interconnects in the same manner as electronic interconnects (column 1 lines 14-26).

2. **Claim 2** is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claim 1 and 9 above, and further in view of **Lee et al (US 2004/0017962 A1)** (Lee).

Thomas teaches the interconnect described above

Thomas does not teach expressly using silicon oxynitride as the core layer.

Lee teaches an optical interconnect using silicon oxynitride as the core layer (paragraph 0047).

Thomas and Lee are analogous art because they are from the same field of endeavor, optical coupling in planar structures.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use silicon oxynitride as the core layer as taught by Lee in the structure taught by Thomas since Thomas teaches a core made of glass (silicon) material.

The motivation for doing so would have been to increase coupling efficiency by choosing materials with high refractive index difference (Lee, paragraph 0047) that insures that light is not leaked into the core.

3. **Claim 3** is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claims 1 and 9 above, and further in view of **Congdon et al (US 5,673,284)** (Congdon).

Thomas teaches the interconnect described above

Thomas does not teach expressly using silicon dioxide as the cladding layer.

Congdon teaches an optical interconnect using silicon dioxide as the cladding layer (column 5 lines 5-16).

Thomas and Congdon are analogous art because they are from the same field of endeavor, optical coupling in planar structures.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use silicon dioxide as the cladding layer as taught by Congdon in the structure taught by Thomas since Thomas teaches a cladding made of a glass material or any other material with sufficient strength to support a glass core (column 3 lines 29-35).

The motivation for doing so would have been to increase coupling efficiency by choosing materials with high refractive index difference that insures that light is not leaked into the core and to ensure mechanical integrity by using materials with needed strength.

4. **Claim 4** is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claims 1 and 9 above, and further in view of what would have been obvious to one of ordinary skill in the art at the time of applicant's invention.

Thomas teaches the interconnect described above.

Thomas does not teach expressly and 50 degree angled sidewall.

At the time the invention was made, it would obvious to a person of ordinary skill in the art to have an angle sidewall as any useable angle. Applicant has not disclosed that exactly 50 degrees or less provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with the interconnect taught by Thomas since light is coupled between the two core layers.

The motivation would have been to increase coupling efficiency by maximizing coupling properties (light angle, materials, wavelength, etc) for maximum coupling efficiency.

5. **Claims 15-24** rejected under 35 U.S.C. 103(a) as being unpatentable over **Giallorenzi (US 3,992,079)** in view of **Tien (US 3,948,583)** and **Kawashima (US 5,124,543)**.

Giallorenzi teaches an optical integrated circuit (Fig. 1) used in an electro-optic system (and therefore, needing circuitry) (column 1 lines 9-21) comprising a substrate (10), a As_2S_3 lower optical waveguide (11) formed over the substrate (10), a $LiNbO_3$ cladding layer (13) having an angled sidewall formed on the lower optical waveguide

(11), a As_2S_3 second waveguide (12) with a first interconnection region (region angled upward from waveguide (11)) formed on the lower waveguide (11) and on the angled sidewall of the cladding layer (13) to form an upper waveguide section (part of 12 above 13) with all of waveguide (11) and waveguide (12) having the same material (same refractive index) and comprises a single structure (column 2 lines 12-24) wherein the indices of refraction of the different materials along with the angle of the angled sidewall define what mode of a light signal is propagated in the two waveguides (column 3 lines 25-35).

Giallorenzi does not teach expressly a lower limit of the sidewall angle being five degrees. According to applicant's specification, the critical angle of the sidewall is less than a critical angle to ensure total internal reflection (page 7 lines 18-19). No lower limit is defined in the specification and therefore a lower limit cannot be critical to the invention.

At the time the invention was made, it would obvious to a person of ordinary skill in the art to select any angle less than a angle to ensure total internal reflection like less then 50 degrees as taught by Tien as described below. Applicant has not disclosed that a lower limit of five degrees provides an advantage, is used for a particular purpose, or solves a stated problem and therefore lacks criticality.

Giallorenzi does not teach expressly the waveguide comprising silicon oxynitride, the cladding layer comprising silicon dioxide or the angled sidewall having an angle less then 50 degrees.

Kawashima teaches an integrated optical circuit (Fig. 3) comprising a core (2) made of silicon oxynitride (column 10 lines 4-5). Tien teaches an integrated optical waveguide (Fig. 3) comprising a less then 50 degree sloped (see the slope labeled 60:1 is the angle from the clad to the horizontal, while the clad to the horizontal would be less) cladding (12) comprising silicon dioxide (column 2 lines 56-57).

Giallorenzi, Kawashima and Tien are analogous art because they are from the same field of endeavor, integrated circuits comprising optical waveguides on substrates.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the materials as taught by Kawashima and Tien to meet the requirement of Giallorenzi that the refractive index of the core be greater then the refractive index of the cladding, as the two materials were well known in the art at the time of the invention. Also, it would have been obvious to a person of ordinary skill in the art to use a gentle slope for the coupling region of the waveguides

The motivation for doing so would have been to ensure light is contained in the waveguides by having the index of refraction of the core larger than the index of refraction of the cladding and to ensure a signal is not lost at the coupling region by having a gentle taper (Tien, column 3 lines 3-6).

Giallorenzi does not teach expressly input and output devices coupled to the circuitry of the waveguide or electronic components coupled to the circuitry.

At the time the invention was made, it would obvious to a person of ordinary skill in the art to couple input, output and electronic devices to an integrated waveguide as needed. Applicant has not disclosed that the limitations of claims 23 and 24 provides

an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with the integrated circuit as taught by Giallorenzi because there is teaching of coupling to other electrically devices as need for the particular application and since the system circuitry is not a critical aspect of the applicant's invention.

The motivation would have been to increase the applications the integrated waveguide may be used in, including filtering and tunable coupling (column 1 lines 5-50).

Allowable Subject Matter

6. **Claims 5-8 and 10-14** are allowed.

With regard to claims 5 and 10: These claims are allowable over the prior art of record because the latter, either alone or in combination, does not disclose nor render obvious a method of optically interconnecting layers in an optical integrated circuit including a substrate by forming a first optical transmission layer over the substrate, forming a first cladding layer on the first optical transmission layer, removing portions of the first cladding layer to form an angled sidewall in the first cladding layer by forming mesa structures at desired locations and removing the mesa structures and portions of the cladding and forming an optical interconnect layer on the angled sidewall of the first cladding layer and on an exposed portion of the first optical transmission layer or forming a second cladding on the first interconnect layer and forming a sidewall in the same fashion or a method of optically interconnecting layers in an optical integrated

circuit including a substrate by forming a first optical transmission layer over the substrate, forming a first cladding layer on the first optical transmission layer, removing portions of the first cladding layer to form an angled sidewall in the first cladding layer and forming an optical interconnect layer on the angled sidewall of the first cladding layer and on an exposed portion of the first optical transmission layer or by removing portions of the first transmission layer and forming a first dielectric layer in the void, removing portions of the first dielectric layer to planarize upper surfaces of the layer in the void regions and forming a first cladding layer on the planarized surface, forming mesa structures on the first cladding, removing the mesa structure to form the angled sidewall and forming a second optical transmission layer on the angled sidewall, in combination with the rest of the claimed limitations.

With regard to claims 6-8 and 11-14: These claims are allowable over the prior art of record because they depend on allowable claims.

Response to Arguments

7. Applicant's arguments with respect to claims 15-24 have been considered but are moot in view of the new ground(s) of rejection. The 112 1st paragraph has been removed since the specification defines an upper limit on the angle that would cover anything under that limit, but since the lower limit has not been defined or stated as critical in the specification it cannot be critical to the invention and is thus rejected as described above.

Applicant's arguments with respect to claims rejected by Thomas have been considered but are moot in view of the new ground(s) of rejection. Again, an arbitrary limit apposed to the angle of the sidewall is not critical since it is not stated in the specification and is only added in hindsight due to the applied prior art references.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan Lepisto whose telephone number is (571) 272-1946. The examiner can normally be reached on M-F 7:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank Font can be reached on (571) 272-2415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

RAL

Ryan Lepisto

Art Unit 2883

Date: 3/28/06

Frank G Font

Frank Font

Supervisory Patent Examiner

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